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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/530,612	12/30/2005	Franz Laermer	10191/3964	6739

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EXAMINER	
ANGADI, MAKI A	
ART UNIT	**PAPER NUMBER**
1792	
MAIL DATE	**DELIVERY MODE**
12/03/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/530,612	LAERMER ET AL.	
	Examiner	Art Unit	
	MAKI A. ANGADI	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 October 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-23,25,26,28-32 and 34-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-23,25,26,28-32 and 34-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 21-23, 25-26, 29-32, 37 and 40 rejected under 103(a) as being unpatentable over Bhardwaj (US Patent No. 6, 051,503) in view of Sadakata (US Patent No. 6, 277,173) and Applicants' Admitted Prior Art (APA)

As to claim 21-23, 29-30 and 40, Bharadwaj discloses a method and a system that reads on the process of anisotropically etching structures (col.1, lines

9-13) into a substrate (col.3, lines 58)(Fig.1) positioned in an etching chamber (col.3, lines 36-37) in particular structures using an etching mask (col.3, lines 58-59) in a semiconductor substrate, using a plasma (col.3, lines 43-45), the intermittent use of passivation and etching gas cycles in the plasma chamber (col.2, lines 5-9, col.3, lines 31-33); providing the etching chamber at least intermittently with an etching gas and passivation gas (col.1, lines 41-48, col.2, lines 5-8, col.3, lines 31-33), wherein the passivation gas is supplied to the etching chamber in cycles each having a time period less than 7.5 seconds and preferably less than 5 seconds (col.10, lines 19-22) which covers the range cited by the applicant; passivation gas used during each of the individual passivation steps is reduced one of continuously and in steps as etching progresses (col.2, lines28-33); passivation gas lines provided upstream/downstream from the etching chamber and gas valves are the inherent part of any reactor system (Fig.1) (col.51-55).

Bharadwaj is silent about the use of buffer tank located along the passivation gas line. However, Sadakata discloses the presence of buffer tank (26)(Fig.2) for a dry etching system (col.4, lines 51-55) and gas valve located down stream from the buffer tank and upstream from the etching chamber (col.6, lines 46-53, Fig. 5). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select buffer tank and passivation gas valves in the plasma processing system employed by Bharadwaj because

Sadakata illustrates that buffer tank and gas valves help to regulate the concentration of gas into the process chamber during etching (col.6, lines 47-54).

Bharadwaj discloses a method that reads on the process of permitting the etching gas and passivation gas (col.1, lines 41-44, col.3, lines 51-55) used alternately during separate etching steps and passivation steps (col.4, lines 3-7) which are controlled independently on one another (col.2, lines 9-23), passivation gas being supplied to the etching chamber largely only during the passivation gas steps (col.6, lines 51-59), the etching gas being supplied to the etching chamber (10) (Fig.1) during the etching steps (col.6 lines 60-67).

Bharadwaj discloses the duration of passivation step and etching step limited to less than 7.5 second (col.10, lines 19-22), which do not differ by a factor of about 10-30. According to Applicants' APA on page 1 (lines 21-25) of the specification, passivation gas steps of 3-5 seconds each and etching steps of 10-12 seconds each alternate with one another are typical values used in the inductively coupled plasma source for high-rate plasma etching of silicon. Therefore, the duration of the passivation and etching steps are dependent on several factors such as etching gas, plasma power density, and the thickness of the polymer layer which are experimental variables that can be optimized depending on the desired outcome for an anisotropic etching of structures. One who is skilled in the art at the time of invention was made would be motivated to optimize through routine experimentation of etching conditions because Bharadwaj illustrates that duration of etch and/or deposition steps may be

controlled to reduce surface roughness (col.2, lines 24-26). See MPEP § 2144.05 II.

As to claim 25, Bharadwaj discloses the passivation gas such as, $C_2H_2F_4$, C_3F_8 and C_4F_8 as passivation gases (col.4, 18-24 and lines 51-67). In addition, applicants' APA provides a list of etching and passivation gases (pages 9-19).

As to claim 26, Bharadwaj discloses a method that reads on the process of permitting the etching gas (col.2, lines 27-32) and passivation gas (col.2, lines 33-37) used alternately during separate etching steps and passivation steps (col.1, lines 42-45), a polymer, (col.5, lines 38-40), being applied to the lateral delimitation of the structures defined by the etching gas, with the aid of the passivation gas during the passivation steps (col.5, lines43-48).

As to claims 31-32, Bharadwaj discloses a vacuum chamber (11) (Fig.1) with etching and passivation gas being supplied to the etching chamber alternately during separate, independently controlled etching and passivation steps, and wherein a region of the etching chamber where the plasma source acts on the etching gas is substantially free of the passivation gas during the etching steps and the plasma source acts on the passivation gas is substantially free of the etching as during the passivation steps(col.3, lines, 38-43, lines 51-57, col.3, lines 62-67, col.4, lines 17-24, col.2, lines 10-23, col.7, lines 17-31); passivation and etching gas lines connect directly into the etching chamber

(col.3, lines 51-57). Bharadwaj does not specify the common feed line has a length of less than 20 cm and feed line into the etching chamber. One who is skill in the art at the time would be able to adjust the length of the feed line so that the reactor chamber is not loaded during pumping of the system.

As to claim 37, Bharawdaj fails to disclose the volume of buffer tank outside the plasma process chamber. However, Sadakata discloses the presence of buffer tank outside the chamber (col.4, 51-55) but is silent about its volume. The volume of the buffer tank in the plasma etch system is dependent on several process parameters such as, gas flow rate, number of gases being used and etch rate and the volume of the process chamber which one who is skilled in the art would be able to optimize through routine experimentation because Sadakata suggests that the surplus gas produced from the recovered gas needs to be stored in the buffer tank or part of part of the recovered surplus gas can be used as gas for starting the gas discharging system (col.5, lines 10-15). See MPEP § 2144.05 II.

Claim Rejections - 35 USC § 103

2. Claim 28 is rejected under 103(a) as being unpatentable over Bhardwaj (US Patent No. 6, 051,503) in view of Sadakata (US Patent No. 6, 277,173) and Applicants' Admitted Prior Art (APA) s applied to claims 21 and 23, in further view of Hwang (US Pub.No. 2003/0059720).

Bhardwaj discloses high-density plasma with ion energy >100 eV (col.3, lines 43-50, col.5, lines 20-24, lines 51-52). Moreover, Bhardwaj is silent about the ion density of the plasma. However, Hwang discloses the use of ion density in the plasma in excess of 10^{11} reactive species/cm^3 (paragraph 0028). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made employ high density plasma in the etching process employed by Bhardwaj because Hwang illustrates that high density plasma chamber possesses a separate control for ion flux and separate control for ion energy (paragraph 0095).

Claim Rejections - 35 USC § 103

3. Claim 34-36 rejected under 103(a) as being unpatentable over Bhardwaj (US Patent No. 6, 051,503) in view of Sadakata (US Patent No. 6, 277,173) and Applicants' Admitted Prior Art (APA) as applied to claim 30, in further view of Papasouliotis (US Patent No. 6, 846,745).

Bhardwaj is silent about the separate use of etching and passivation gas into the chamber and mixing of these gases. However, Papasouliotis discloses the use of a fluorine-containing species for etching and hydrogen-containing species as a process gas into the process chamber (Fig.3) (col.2, lines 40-47). Papasouliotis discloses the mixing of etching and passivating gases through a valve or primary gas ring (col.12, lines 49-67). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select passivation gas and etching gas and mixing these gases through a

common valve in the process chamber described by Bhardwaj because Papasouliotis illustrates that by separately employing a fluorine etch and a hydrogen passivation cycles, dielectric deposition is greatly improved (col.3, lines 55-60).

As to claim 35, Bhardwaj is silent about the positioning of the etching gas valve and passivating gas valve in the etching system. However, Papasouliotis discloses the use of passivating and etching gas valves in the system but do not expressly state their position. The position of gas valves can be varied depending on the etch rate, concentration of gases, flow rate and other experimental conditions. One who is skilled in the art at the time the invention was made to select the position of valve with respect to the chamber for achieving the desired efficiency and productivity of the system.

Claim Rejections - 35 USC § 103

4. Claims 38-39 rejected under 103(a) as being unpatentable over Bhardwaj (US Patent No. 6, 051,503) in view of Sadakata (US Patent No. 6, 277,173) and Applicants' Admitted Prior Art (APA)as applied to claims 30, 32, in further view of Hartig (US Patent No. 5, 683,548).

Bharadwaj discloses a reactor chamber surrounded by a coil and fed by a RF source (col.3, lines 43-44) but is silent about the use of an inductively coupled plasma. However, Hartig discloses an inductively coupled plasma reactor and a process to generate plasma for etching or depositing a material layer (col.2, lines

14-18) which is powered by an RF power supply system (18) to RF coils (54, 56) in the plasma source (16) in the range of about 100 to about 5000 watts applied to the substrate (col.7, lines 18-24). Hartig discloses the presence of at least two coils (54, 56, Fig.5) (col.4, lines 48-63), one above the other, the two coils with current flowing in opposite direction with at least two coils provided between the plasma and the substrate (Fig.1-2 col.4, lines 48-63). Therefore, it would have been obvious to one of ordinary skill in the at the time the invention was made to select inductively plasma source and reactor with at least two coils in the chamber employed by Bharadwaj because Hartig illustrates that inductively coupled plasma reactor provides a plasma density and composition than can be spatially varied within the plasma reactor (col.3, lines 7-11). Hartig does not specify the internal diameter of the etching chamber, which can be varied, depending the spatial uniformity of the plasma. One who is skilled in the art, according to Hartig, would choose chamber designs and vacuum port arrangements to meet plasma process conditions (col.4, lines 2-6).

Response to Arguments

5. Applicant's arguments filed on 10/9/2008 have been fully considered but they are not persuasive.

(a) *With respect to amended claim 21,* applicants arguments on pages 2-3 of the reply asserting that the combined prior art of Bhardwaj (US Patent No. 6, 051,503) and Sadakata (US Patent No. 6, 277,173) do not suggest that the duration of passivation steps is set to be shorter than the duration of etching

steps by a factor of 10 to 30 are not persuasive. It appears that the disclosed process parameters (col.6, lines 50-67) disclosed in the reference of Bhardwaj could encompass applicants' claimed duration of passivation and etching. Applicants have not demonstrated anything unexpected with respect to the specifically claimed passivation time or etch/passivation ratio.

(b) *With respect to claim 25,* Applicants' arguments on page 5 of the reply asserting that the reference of Bhardwaj and Sadakata do not discloses passivation and etching gases are not persuasive. The etching and passivation gases which are commonly used in plasma etching processes are disclosed in the reference of Bharadwaj (col.1, lines 41-44) and additional etching passivation gases are discloses in applicants' APA on page 1.

(c) *With respect to claim 29,* Sadakata discloses the passivation and etch gas flow rates (col.7, lines 24-29) and one who is skilled in the art should be able to adjust the flow rate to optimize conditions for plasma etching.

(d) *With respect to claim 30,* Sdakata discloses the position of buffer tank in the dry etching system. One who is skilled in the art should be able to position the buffer tank upstream from the etching chamber and regulate gas by controlling gas valves.

(e) *With respect to claims 38 and 39,* applicants' arguments on pages 9-10 are again not persuasive. The references of Bharadwaj and Hartig disclose the process parameters which includes RF power that can be used to estimate the power density depending on coil dimensions. The reference of Hartig shows the

position of RF coils (54) located externally and the current associated with these coils (Fig.2, col.4, lines 48-60).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maki A. Angadi whose telephone number is 571-272-8213. The examiner can normally be reached on 8 AM to 4.30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Maki A Angadi/
Examiner, Art Unit 1792

/Nadine G Norton/

Supervisory Patent Examiner, Art Unit 1792

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/530,612	LAERMER ET AL.	
	Examiner	Art Unit	
	MAKI A. ANGADI	1792	